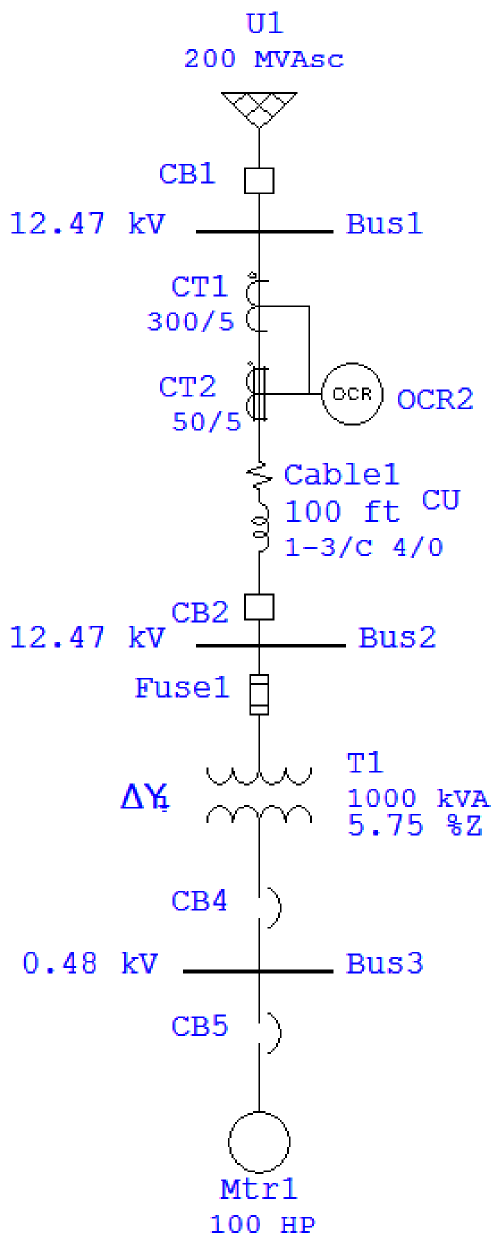
Star Exercise 1A

Purpose

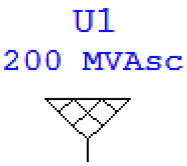
1. To navigate and retrieve data from each library into respective devices
2. To test the protection and coordination settings of this system by generating TCCs
3. Demonstrate STAR TCC Features

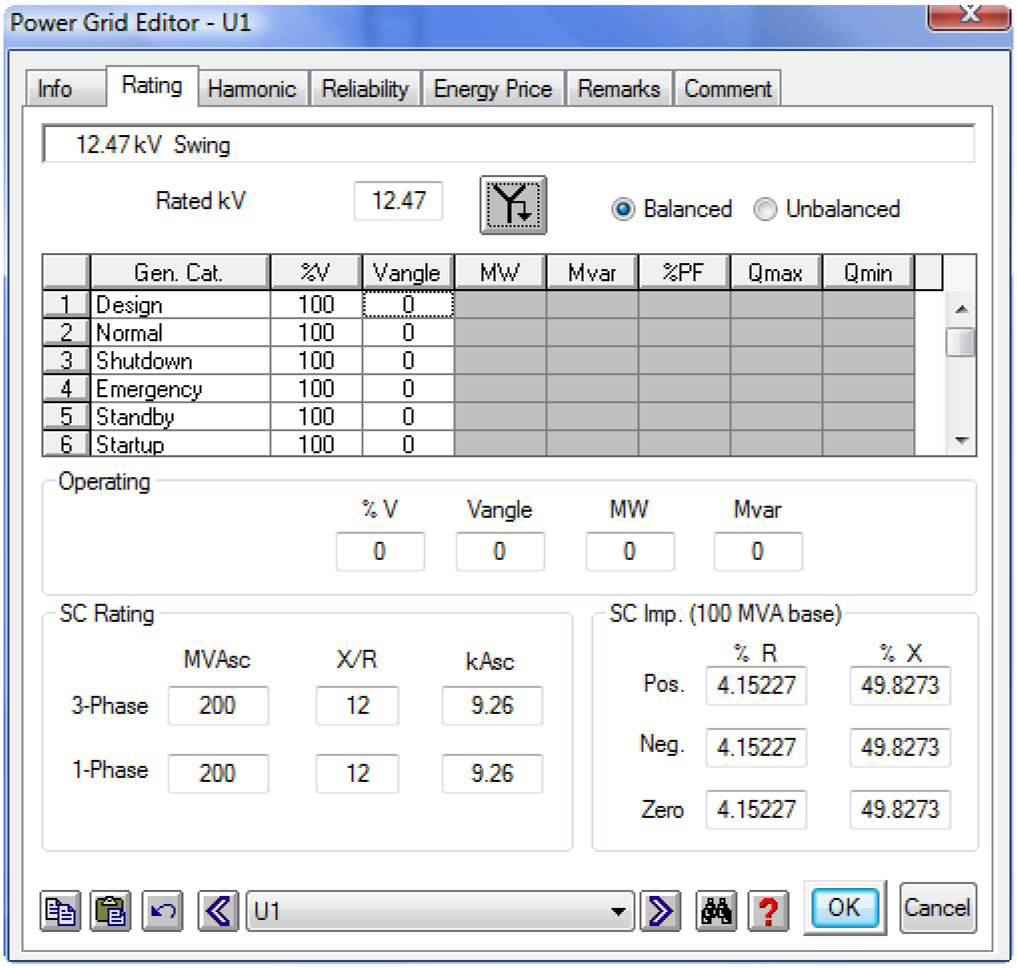
Procedure

1. Open project STAR_Exercise1A
2. Create the One-line Diagram for the system
3. Input data for the elements shown below


U1
200 MVAsc
CB1
12.47 kV
Bus1
CT1
300/5
CT2
50/5
OCR
OCR2
Cable1
100 ft
CU
1-3/C 4/0
CB2
12.47 kV
Bus2
Fuse1
ΔY
T1
1000 kVA
5.75 %Z
CB4
0.48 kV
Bus3
CB5
Mtr1
100 HP

Star Exercise 1A


U1
200 MVAsc


Power Grid Editor - U1
Info
Rating
Harmonic
Reliability
Energy Price
Remarks
Comment
OK
Cancel

12.47 kV Swing

Rated kV: 12.47

● Balanced ○ Unbalanced

	Gen. Cat.	%V	Vangle	MW	Mvar	%PF	Qmax	Qmin
1	Design	100	0					
2	Normal	100	0					
3	Shutdown	100	0					
4	Emergency	100	0					
5	Standby	100	0					
6	Startup	100	0					

Operating

% V	Vangle	MW	Mvar
0	0	0	0

SC Rating

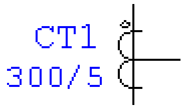
	MVAsc	X/R	kAsc
3-Phase	200	12	9.26
1-Phase	200	12	9.26

SC Imp. (100 MVA base)

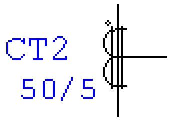
	% R	% X
Pos.	4.15227	49.8273
Neg.	4.15227	49.8273
Zero	4.15227	49.8273

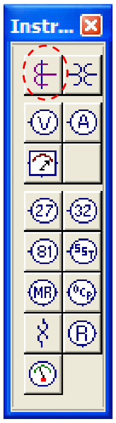
U1

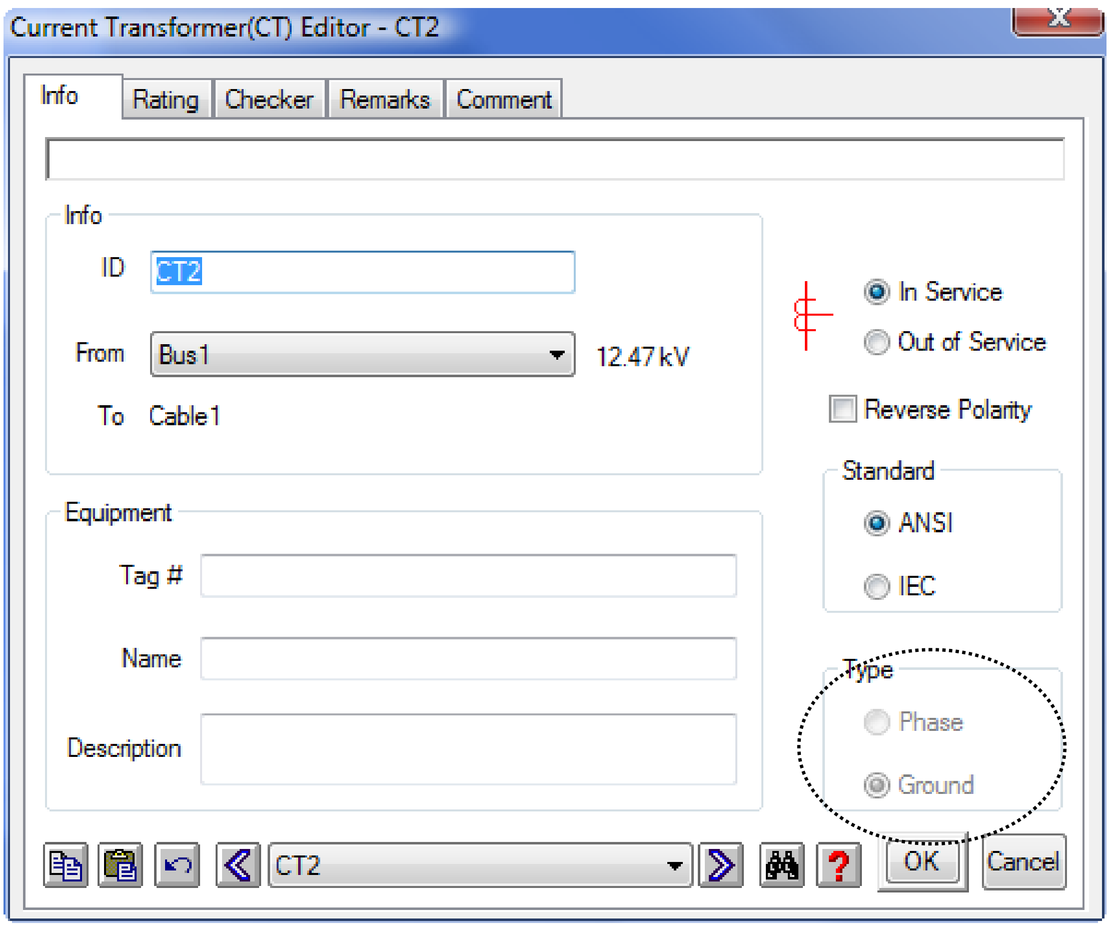
Phase CT



Ground CT




Instr...
27
32
81
MR
R


Current Transformer(CT) Editor - CT2
Info
Rating
Checker
Remarks
Comment
OK
Cancel

Info

ID CT2

From Bus1 12.47 kV

To Cable1

● In Service
○ Out of Service

☐ Reverse Polarity

Standard

● ANSI
○ IEC

Equipment

Tag #

Name

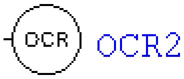
Description

Type

○ Phase
● Ground

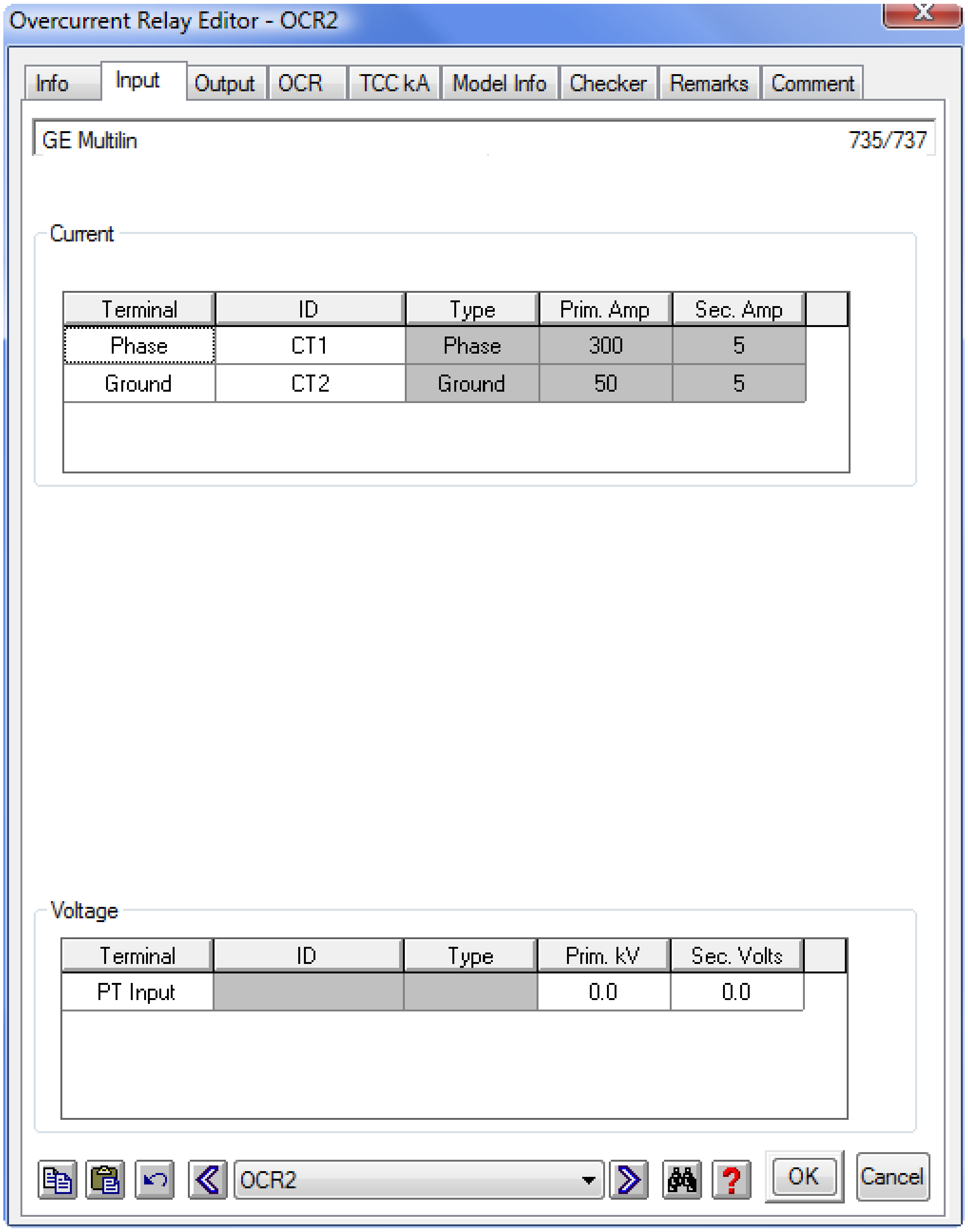
CT2

Overcurrent Relay



Select GE Multilin Relay 735/737.

Note that the selected relay type has two input types: Phase and Ground


Overcurrent Relay Editor - OCR2
Info
Input
Output
OCR
TCC kA
Model Info
Checker
Remarks
Comment
OCR2
OK
Cancel

GE Multilin 735/737

Current

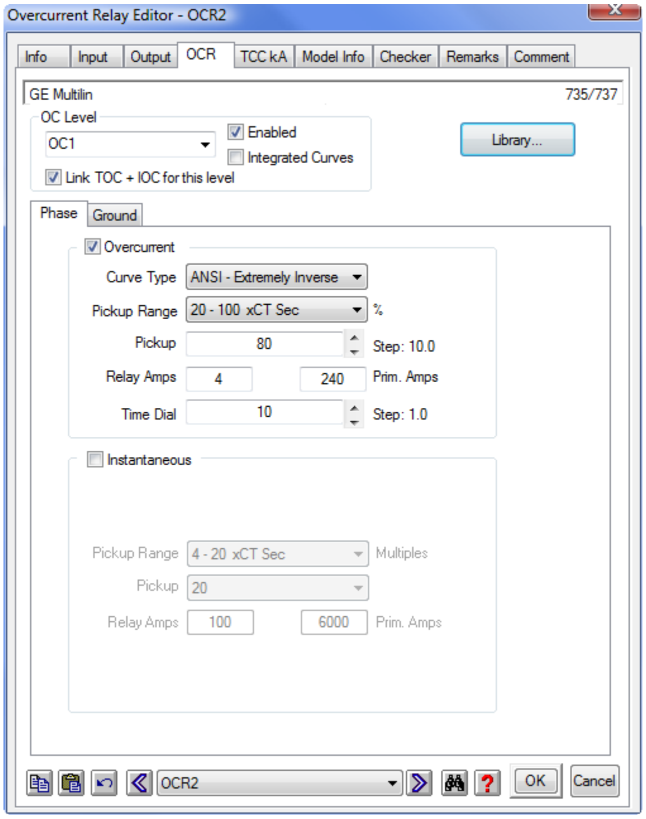
Terminal	ID	Type	Prim. Amp	Sec. Amp
Phase	CT1	Phase	300	5
Ground	CT2	Ground	50	5

Voltage

Terminal	ID	Type	Prim. kV	Sec. Volts
PT Input			0.0	0.0

Star Exercise 1A

Phase Settings


Info
Input
Output
OCR
TCC kA
Model Info
Checker
Remarks
Comment
Library...
Phase
Ground
OK
Cancel

Overcurrent Relay Editor - OCR2

GE Multilin 735/737

OC Level: OC1

☑ Enabled

☐ Integrated Curves

☑ Link TOC + IOC for this level

☑ Overcurrent

Curve Type: ANSI - Extremely Inverse

Pickup Range: 20 - 100 xCT Sec %

Pickup: 80 Step: 10.0

Relay Amps: 4 240 Prim. Amps

Time Dial: 10 Step: 1.0

☐ Instantaneous

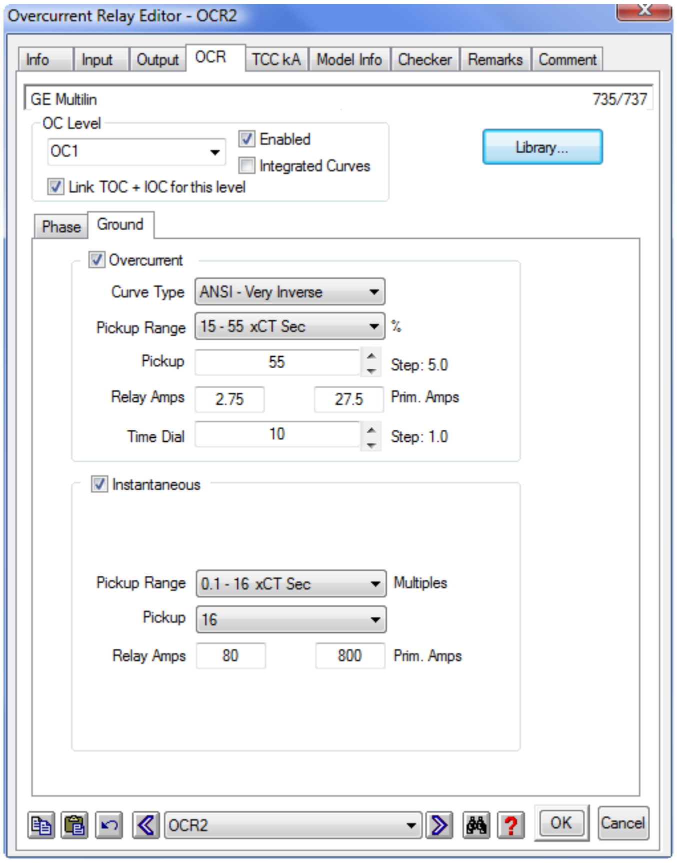
Pickup Range: 4 - 20 xCT Sec Multiples

Pickup: 20

Relay Amps: 100 6000 Prim. Amps

OCR2

Ground Settings


Info
Input
Output
OCR
TCC kA
Model Info
Checker
Remarks
Comment
Library...
Phase
Ground
OK
Cancel

Overcurrent Relay Editor - OCR2

GE Multilin 735/737

OC Level: OC1

☑ Enabled

☐ Integrated Curves

☑ Link TOC + IOC for this level

☑ Overcurrent

Curve Type: ANSI - Very Inverse

Pickup Range: 15 - 55 xCT Sec %

Pickup: 55 Step: 5.0

Relay Amps: 2.75 27.5 Prim. Amps

Time Dial: 10 Step: 1.0

☑ Instantaneous

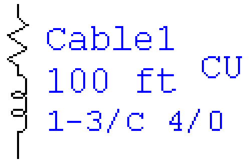
Pickup Range: 0.1 - 16 xCT Sec Multiples

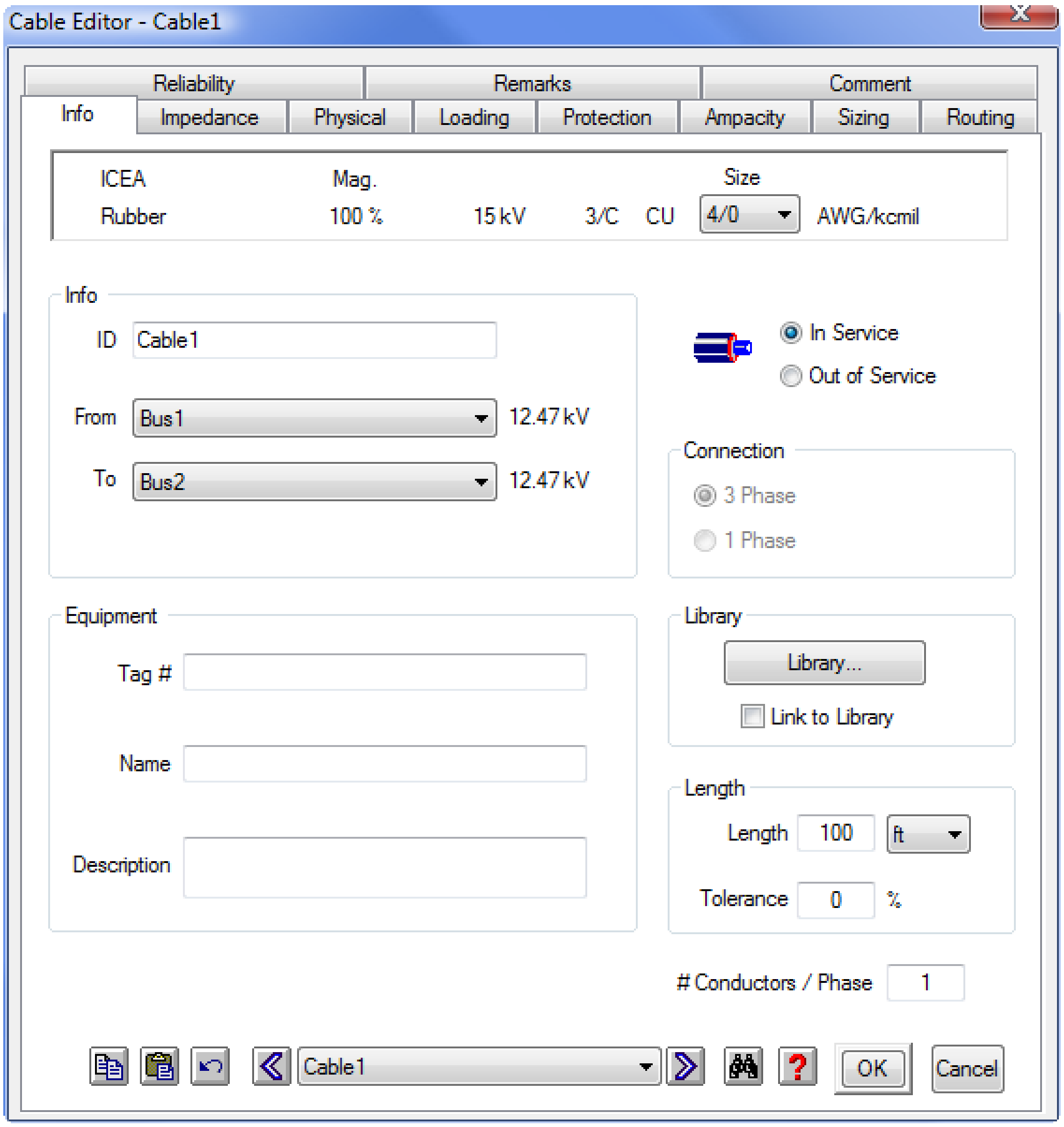
Pickup: 16

Relay Amps: 80 800 Prim. Amps

OCR2

Cable


Cable1
100 ft
CU
1-3/C 4/0


Reliability
Remarks
Comment
Info
Impedance
Physical
Loading
Protection
Ampacity
Sizing
Routing
Library...
OK
Cancel

Cable Editor - Cable1

ICEA Rubber

Mag. 100 %

15 kV 3/C CU

Size 4/0 AWG/kcmil

Info

ID Cable1

From Bus1 12.47 kV

To Bus2 12.47 kV

● In Service
○ Out of Service

Connection
● 3 Phase
○ 1 Phase

Equipment

Tag #

Name

Description

Library
☐ Link to Library

Length

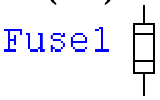
Length 100 ft

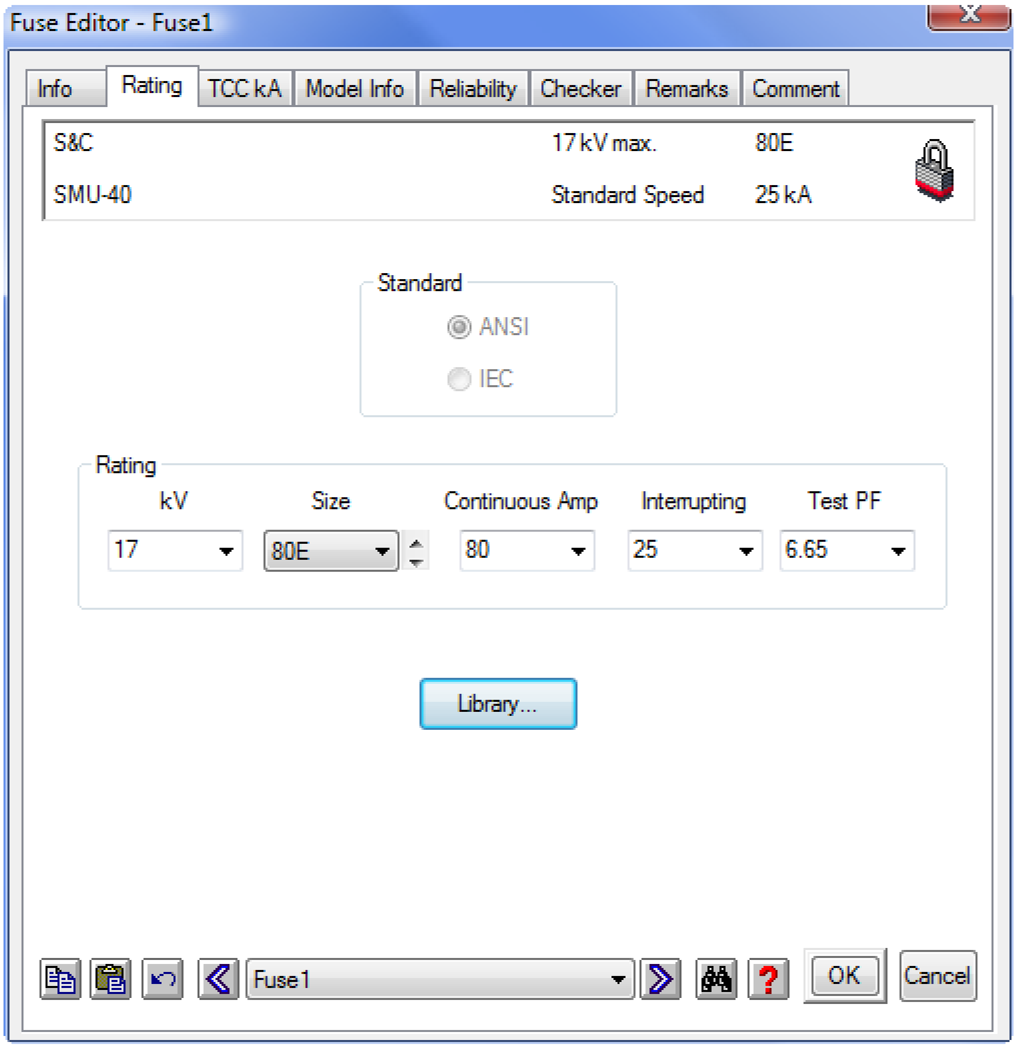
Tolerance 0 %

Conductors / Phase 1

Cable1

Fuse (AC)




Fuse Editor - Fuse1
Info
Rating
TCC kA
Model Info
Reliability
Checker
Remarks
Comment
Library...
OK
Cancel

S&C — 17 kV max. — 80E

SMU-40 — Standard Speed — 25 kA

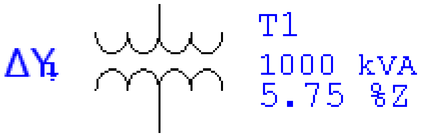
Standard: ● ANSI ○ IEC

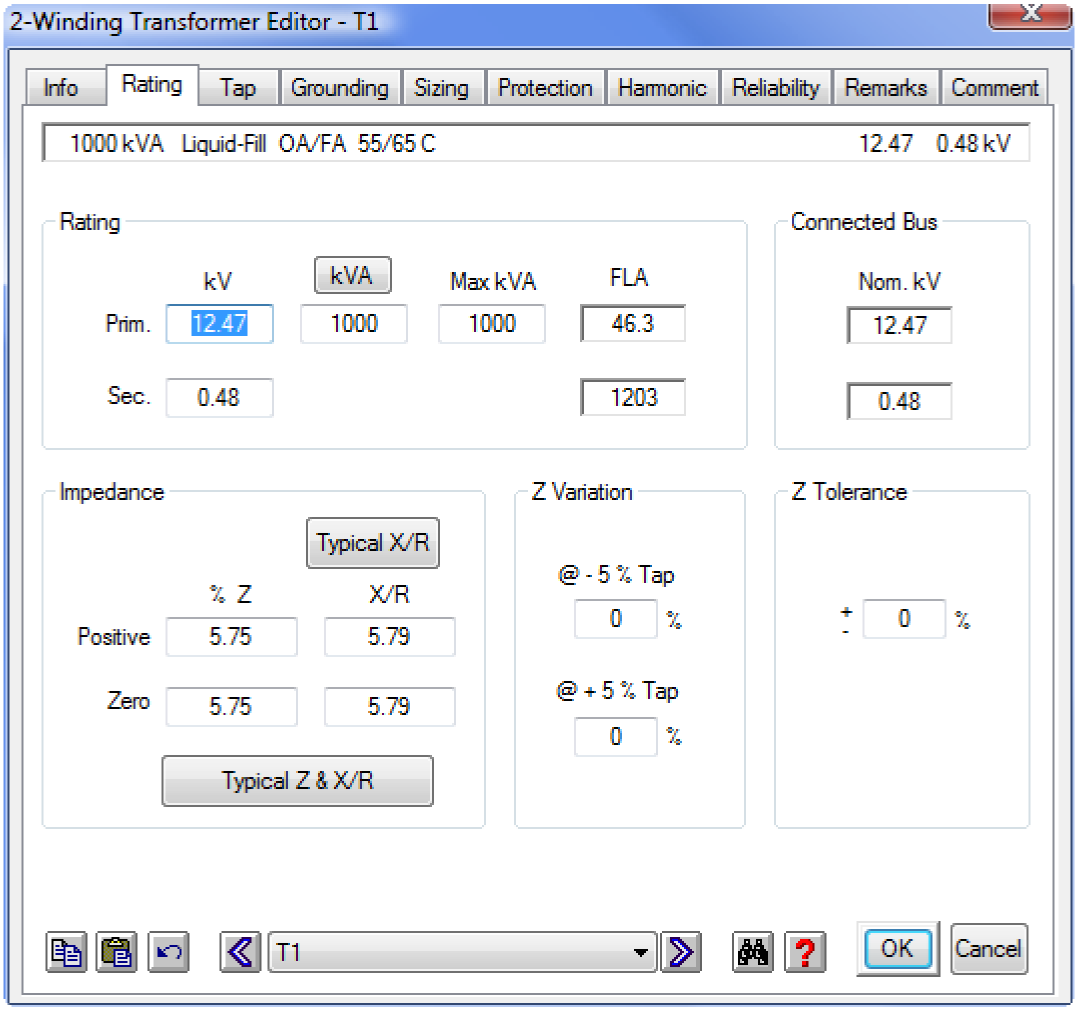
Rating

kV	Size	Continuous Amp	Interrupting	Test PF
17	80E	80	25	6.65

Fuse1

2-W Transformer


ΔY
T1
1000 kVA
5.75 %Z


2-Winding Transformer Editor - T1
Info
Rating
Tap
Grounding
Sizing
Protection
Harmonic
Reliability
Remarks
Comment
Typical X/R
Typical Z & X/R
OK
Cancel

1000 kVA Liquid-Fill OA/FA 55/65 C 12.47 0.48 kV

Rating

	kV	kVA	Max kVA	FLA
Prim.	12.47	1000	1000	46.3
Sec.	0.48			1203

Connected Bus

Nom. kV: 12.47, 0.48

Impedance

	% Z	X/R
Positive	5.75	5.79
Zero	5.75	5.79

Z Variation

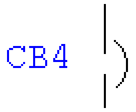
@ - 5 % Tap: 0 %

@ + 5 % Tap: 0 %

Z Tolerance

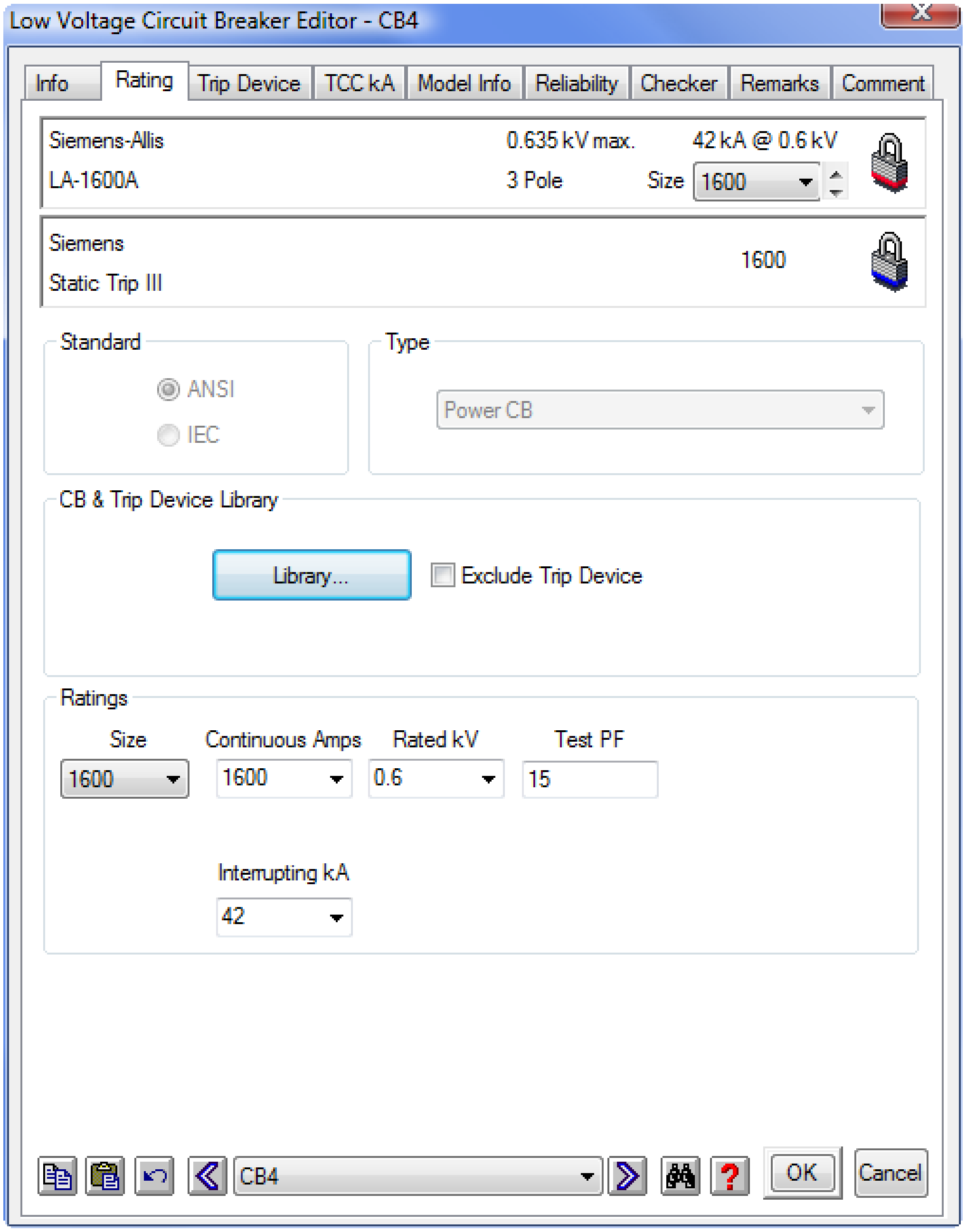
± 0 %

T1



Low Voltage Circuit Breaker (LVCB AC)

Circuit Breaker Rating:


Low Voltage Circuit Breaker Editor - CB4
Info
Rating
Trip Device
TCC kA
Model Info
Reliability
Checker
Remarks
Comment
Library...
OK
Cancel

Siemens-Allis
LA-1600A
0.635 kV max.
3 Pole
42 kA @ 0.6 kV
Size 1600

Siemens
Static Trip III
1600

Standard: ● ANSI ○ IEC

Type: Power CB

CB & Trip Device Library: ☐ Exclude Trip Device

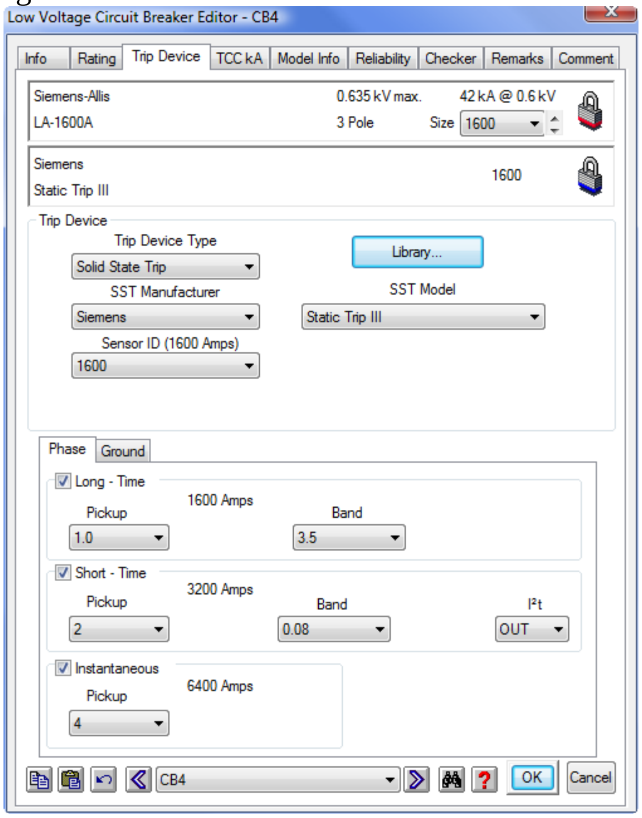
Ratings

Size	Continuous Amps	Rated kV	Test PF
1600	1600	0.6	15

Interrupting kA: 42

CB4

Trip Device Phase Settings:



Low Voltage Circuit Breaker Editor - CB4

Info
Rating
Trip Device
TCC kA
Model Info
Reliability
Checker
Remarks
Comment

Siemens-Allis
LA-1600A
0.635 kV max.
3 Pole
42 kA @ 0.6 kV
Size 1600

Siemens
Static Trip III
1600

Trip Device

Trip Device Type: Solid State Trip
SST Manufacturer: Siemens
Sensor ID (1600 Amps): 1600
SST Model: Static Trip III

Library...
Phase
Ground

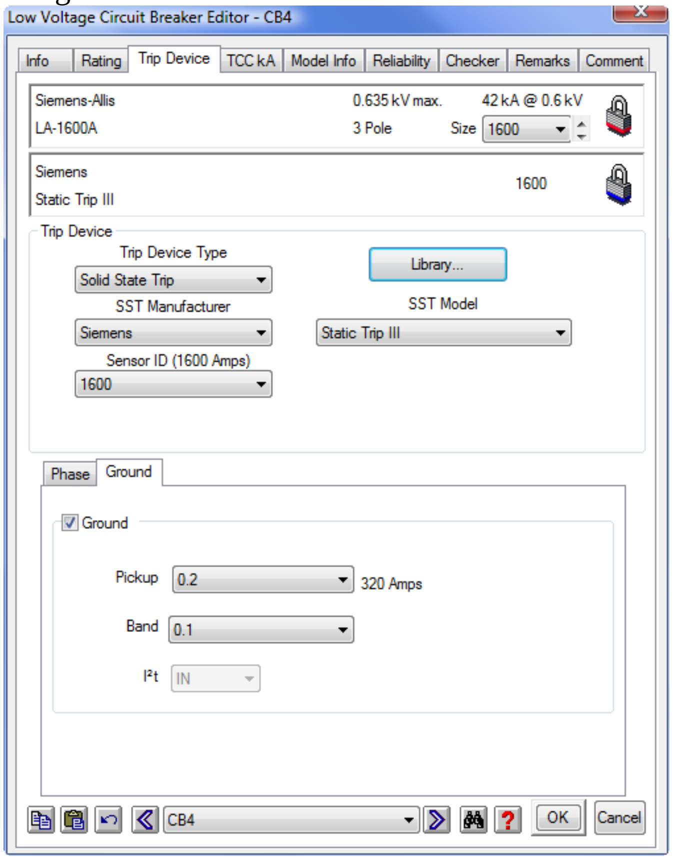
☑ Long - Time
Pickup: 1.0
1600 Amps
Band: 3.5

☑ Short - Time
Pickup: 2
3200 Amps
Band: 0.08
I²t: OUT

☑ Instantaneous
Pickup: 4
6400 Amps

CB4
OK
Cancel

Trip Device Ground Settings:



Low Voltage Circuit Breaker Editor - CB4

Info
Rating
Trip Device
TCC kA
Model Info
Reliability
Checker
Remarks
Comment

Siemens-Allis
LA-1600A
0.635 kV max.
3 Pole
42 kA @ 0.6 kV
Size 1600

Siemens
Static Trip III
1600

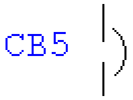
Trip Device

Trip Device Type: Solid State Trip
SST Manufacturer: Siemens
Sensor ID (1600 Amps): 1600
SST Model: Static Trip III

Library...
Phase
Ground

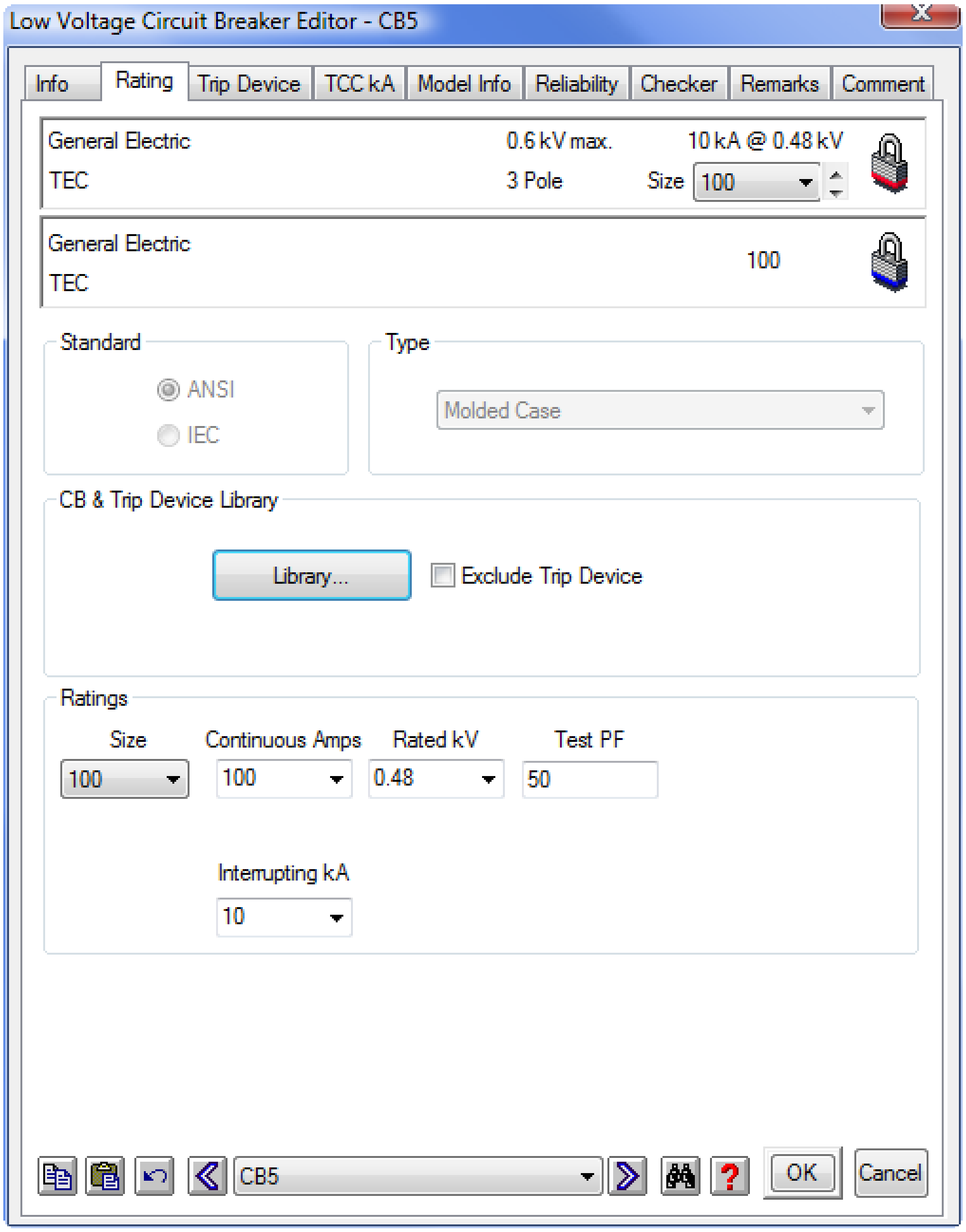
☑ Ground
Pickup: 0.2
320 Amps
Band: 0.1
I²t: IN

CB4
OK
Cancel



Low Voltage Circuit Breaker (LVCB AC)

Circuit Breaker Rating:


Info
Rating
Trip Device
TCC kA
Model Info
Reliability
Checker
Remarks
Comment
Library...
OK
Cancel

Low Voltage Circuit Breaker Editor - CB5

General Electric
TEC
0.6 kV max.
3 Pole
10 kA @ 0.48 kV
Size 100

General Electric
TEC
100

Standard
● ANSI
○ IEC

Type: Molded Case

CB & Trip Device Library
☐ Exclude Trip Device

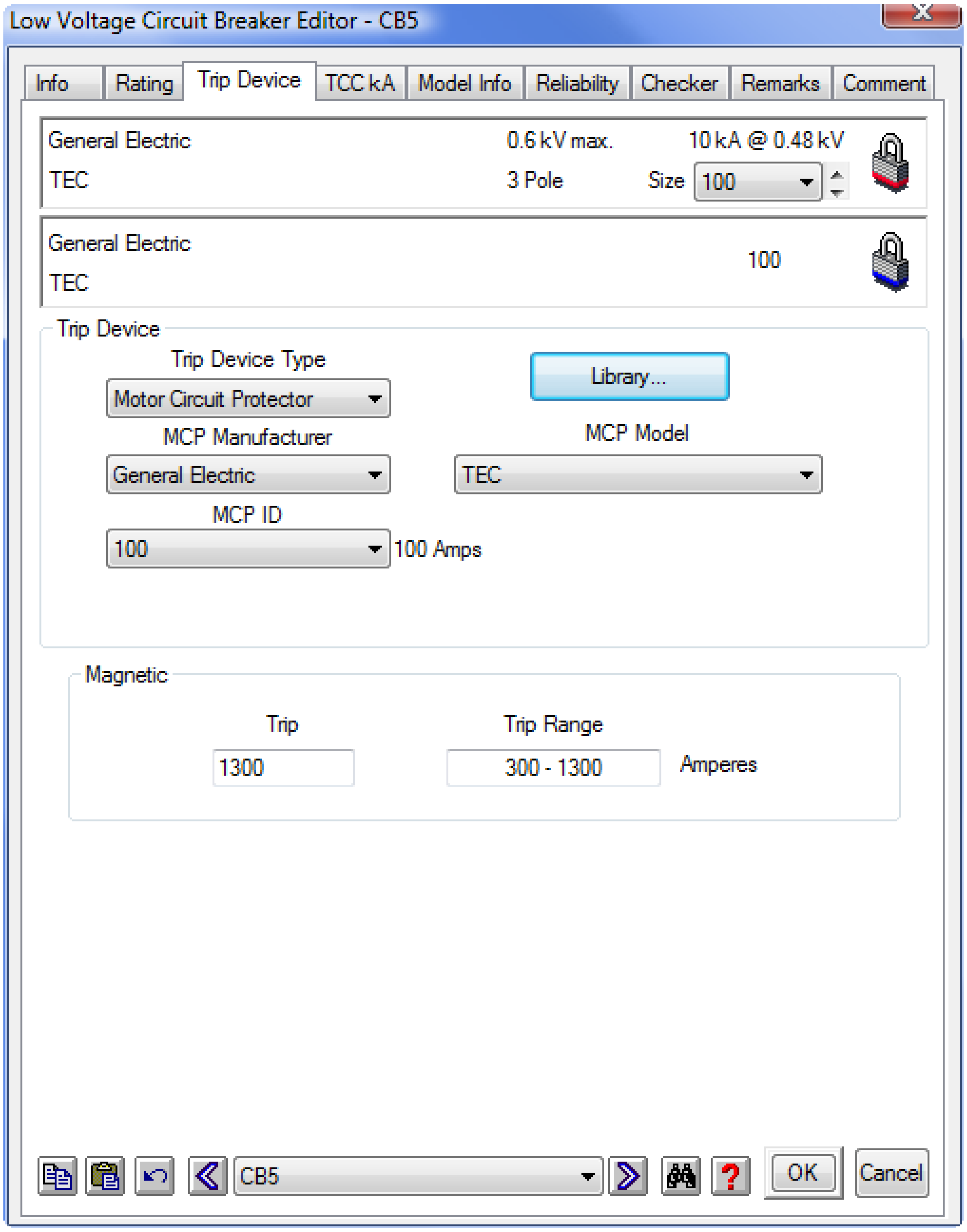
Ratings

Size	Continuous Amps	Rated kV	Test PF
100	100	0.48	50

Interrupting kA: 10

CB5

Trip Device Settings



Low Voltage Circuit Breaker Editor - CB5

Info
Rating
Trip Device
TCC kA
Model Info
Reliability
Checker
Remarks
Comment

General Electric 0.6 kV max. 10 kA @ 0.48 kV
TEC 3 Pole Size 100

General Electric 100
TEC

Trip Device

Trip Device Type: Motor Circuit Protector

Library...

MCP Manufacturer: General Electric

MCP Model: TEC

MCP ID: 100 100 Amps

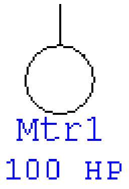
Magnetic

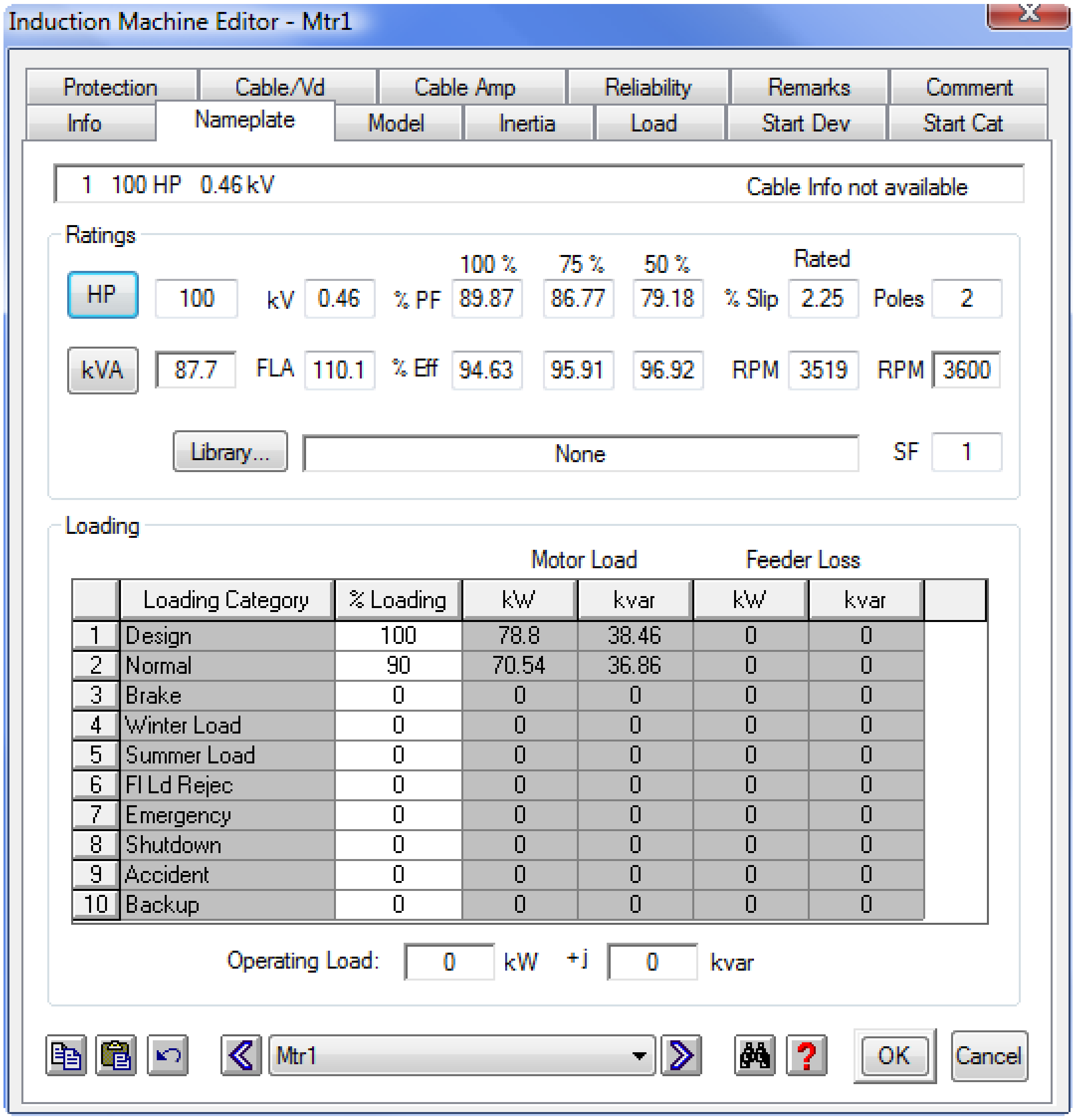
Trip: 1300

Trip Range: 300 - 1300 Amperes

CB5
OK
Cancel

Induction Motor




Protection
Cable/Vd
Cable Amp
Reliability
Remarks
Comment
Info
Nameplate
Model
Inertia
Load
Start Dev
Start Cat
Library...
OK
Cancel

Induction Machine Editor - Mtr1

1 100 HP 0.46 kV — Cable Info not available

Ratings

				100 %	75 %	50 %		Rated		
HP	100	kV	0.46	% PF 89.87	86.77	79.18	% Slip	2.25	Poles	2
kVA	87.7	FLA	110.1	% Eff 94.63	95.91	96.92	RPM	3519	RPM	3600

Library: None — SF: 1

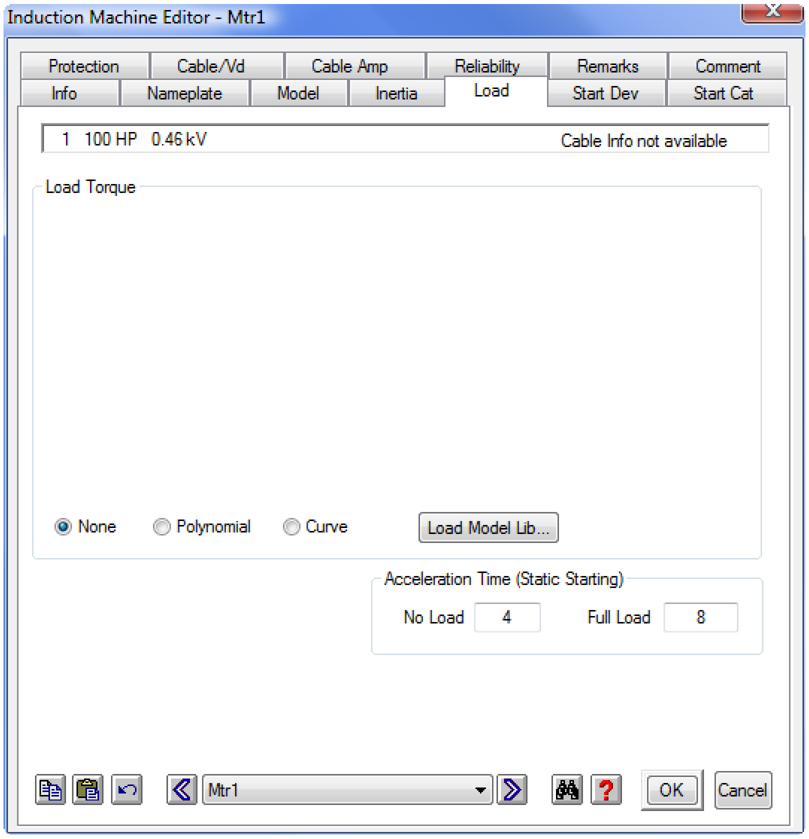
Loading

			Motor Load		Feeder Loss	
	Loading Category	% Loading	kW	kvar	kW	kvar
1	Design	100	78.8	38.46	0	0
2	Normal	90	70.54	36.86	0	0
3	Brake	0	0	0	0	0
4	Winter Load	0	0	0	0	0
5	Summer Load	0	0	0	0	0
6	Fl Ld Rejec	0	0	0	0	0
7	Emergency	0	0	0	0	0
8	Shutdown	0	0	0	0	0
9	Accident	0	0	0	0	0
10	Backup	0	0	0	0	0

Operating Load: 0 kW +j 0 kvar

Mtr1

Star Exercise 1A



Induction Machine Editor - Mtr1

Protection
Cable/Vd
Cable Amp
Reliability
Remarks
Comment
Info
Nameplate
Model
Inertia
Load
Start Dev
Start Cat

1 100 HP 0.46 kV Cable Info not available

Load Torque

● None ○ Polynomial ○ Curve

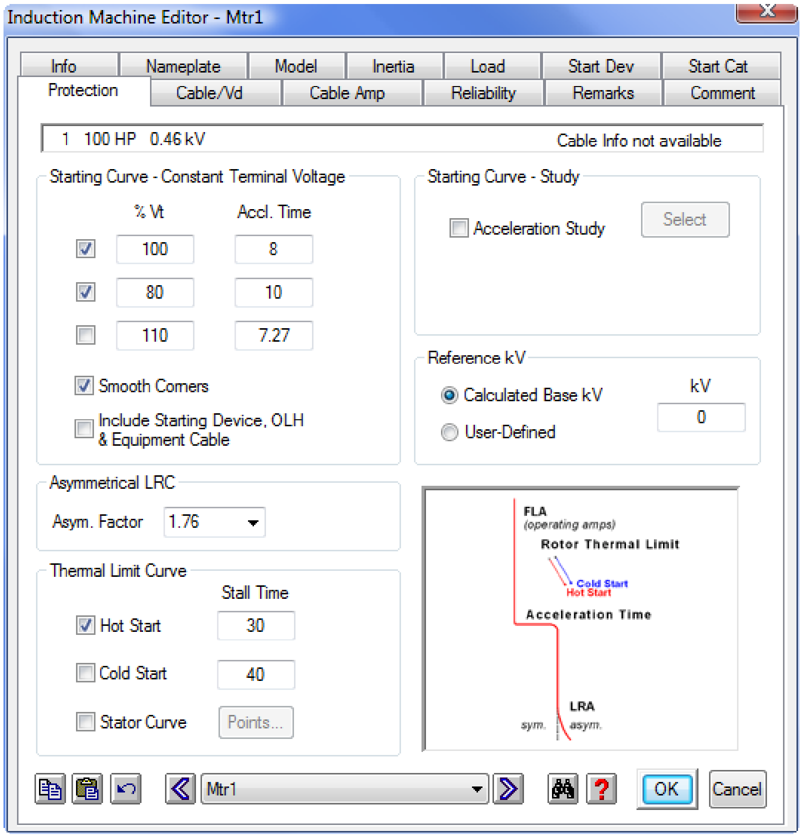
Load Model Lib...

Acceleration Time (Static Starting)

No Load: 4 Full Load: 8

Mtr1

OK
Cancel



Induction Machine Editor - Mtr1

Info
Nameplate
Model
Inertia
Load
Start Dev
Start Cat
Protection
Cable/Vd
Cable Amp
Reliability
Remarks
Comment

1 100 HP 0.46 kV Cable Info not available

Starting Curve - Constant Terminal Voltage

	% Vt	Accl. Time
☑	100	8
☑	80	10
☐	110	7.27

☑ Smooth Corners

☐ Include Starting Device, OLH & Equipment Cable

Starting Curve - Study

☐ Acceleration Study

Select

Reference kV

● Calculated Base kV

○ User-Defined

kV: 0

Asymmetrical LRC

Asym. Factor: 1.76

Thermal Limit Curve

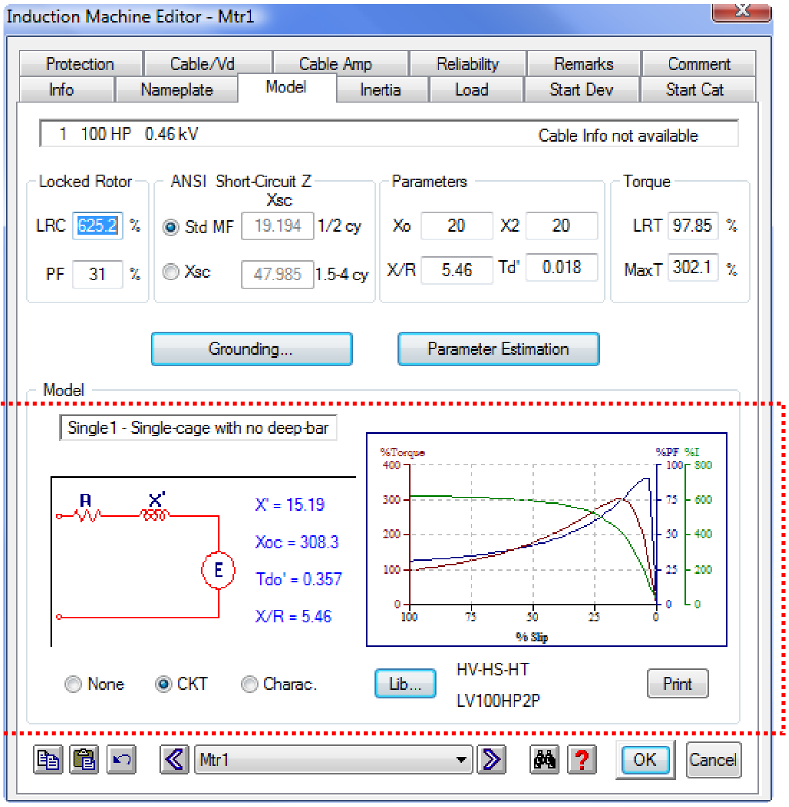
	Stall Time
☑ Hot Start	30
☐ Cold Start	40
☐ Stator Curve	Points...

FLA
(operating amps)
Rotor Thermal Limit
Cold Start
Hot Start
Acceleration Time
LRA
sym.
asym.

Mtr1

Star Exercise 1A

Optional: Using motor acceleration plot from MS Study


Induction Machine Editor - Mtr1
Protection
Cable/Vd
Cable Amp
Reliability
Remarks
Comment
Info
Nameplate
Model
Inertia
Load
Start Dev
Start Cat
Grounding...
Parameter Estimation
%Torque
%PF
%I
400
300
200
100
0
100
75
50
25
0
800
600
400
200
0
% Slip
R
X'
E
Lib...
Print
Mtr1
OK
Cancel

1 100 HP 0.46 kV

Cable Info not available

Locked Rotor

LRC 625.2 %

PF 31 %

ANSI Short-Circuit Z

Xsc

● Std MF 19.194 1/2 cy

○ Xsc 47.985 1.5-4 cy

Parameters

Xo 20 X2 20

X/R 5.46 Td' 0.018

Torque

LRT 97.85 %

MaxT 302.1 %

Model

Single1 - Single-cage with no deep-bar

X' = 15.19

Xoc = 308.3

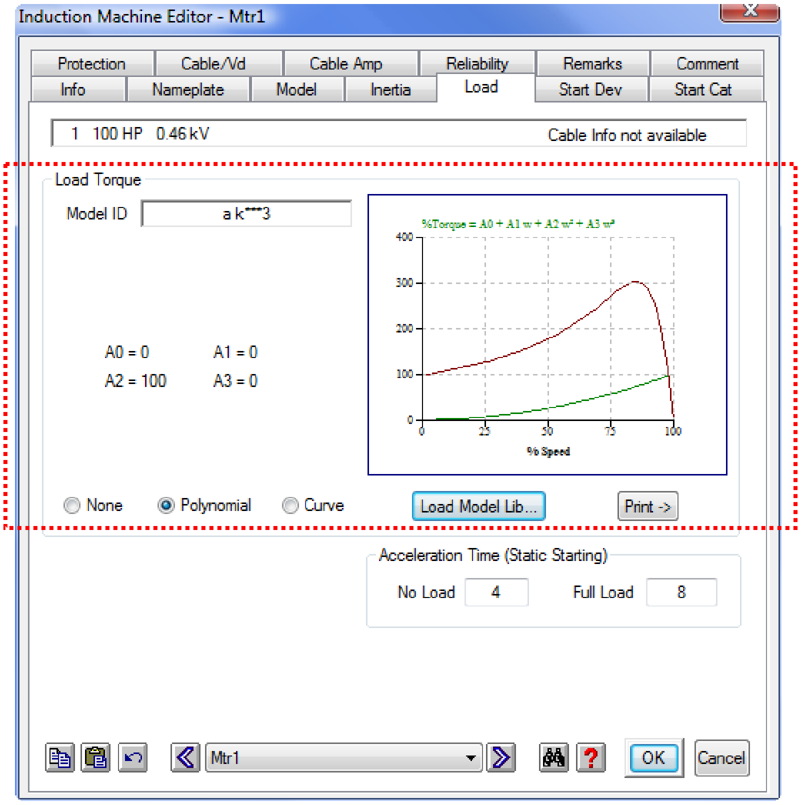
Tdo' = 0.357

X/R = 5.46

○ None ● CKT ○ Charac.

HV-HS-HT

LV100HP2P


Induction Machine Editor - Mtr1
Protection
Cable/Vd
Cable Amp
Reliability
Remarks
Comment
Info
Nameplate
Model
Inertia
Load
Start Dev
Start Cat
%Torque = A0 + A1 w + A2 w² + A3 w³
400
300
200
100
0
0
25
50
75
100
% Speed
Load Model Lib...
Print ->
Mtr1
OK
Cancel

1 100 HP 0.46 kV

Cable Info not available

Load Torque

Model ID a k***3

A0 = 0 A1 = 0

A2 = 100 A3 = 0

○ None ● Polynomial ○ Curve

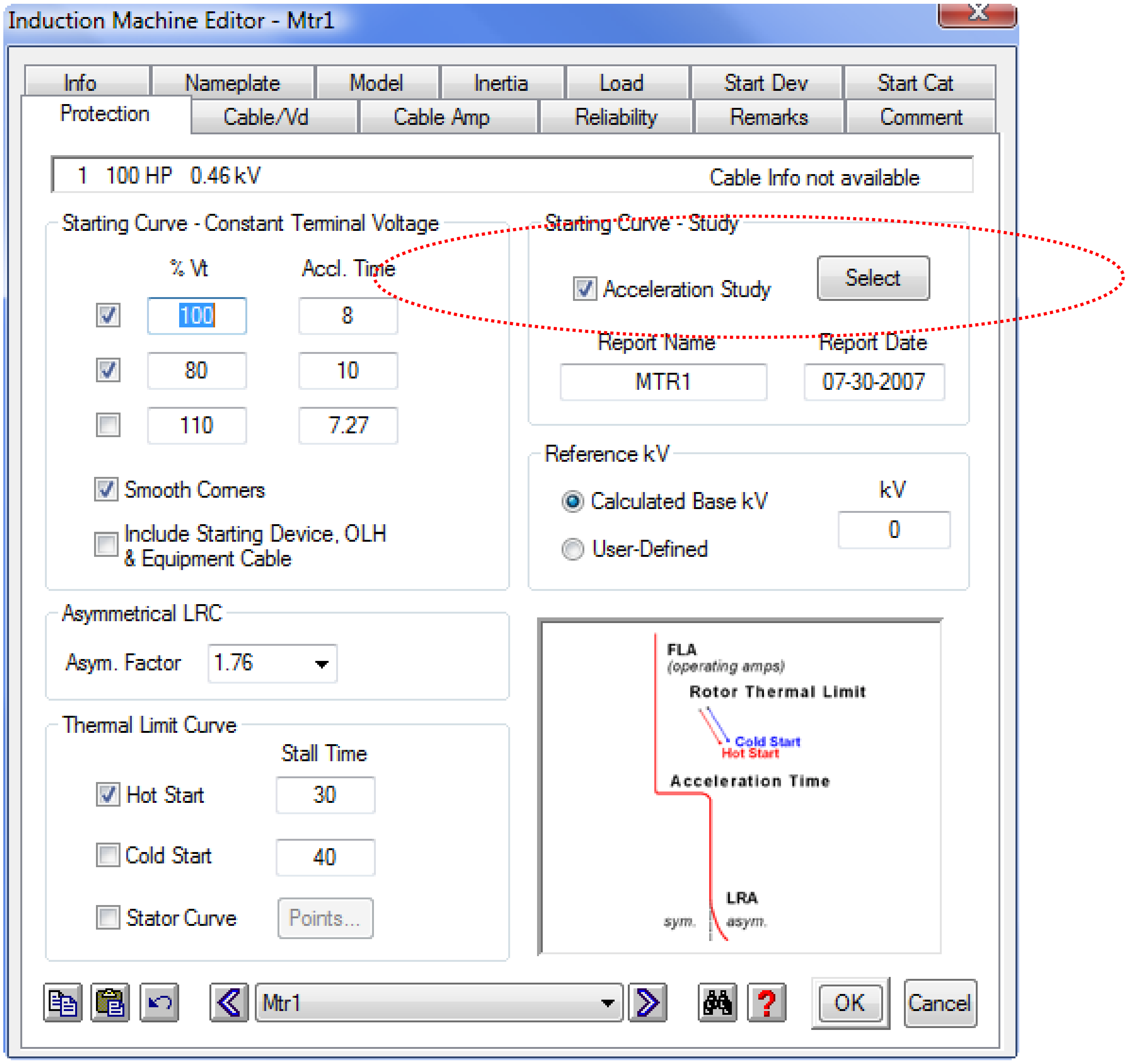
Acceleration Time (Static Starting)

No Load 4 Full Load 8

Star Exercise 1A

- Run Motor Acceleration with Mtr1 starting at 0.1 seconds. Name the output report as MTR1

- Select Motor Acceleration Study (MTR1) curve


Info
Nameplate
Model
Inertia
Load
Start Dev
Start Cat
Protection
Cable/Vd
Cable Amp
Reliability
Remarks
Comment
Select
Points...
FLA
(operating amps)
Rotor Thermal Limit
Cold Start
Hot Start
Acceleration Time
LRA
sym.
asym.
Mtr1
OK
Cancel

Induction Machine Editor - Mtr1

1   100 HP   0.46 kV   Cable Info not available

Starting Curve - Constant Terminal Voltage

	% Vt	Accl. Time
☑	100	8
☑	80	10
☐	110	7.27

☑ Smooth Corners

☐ Include Starting Device, OLH & Equipment Cable

Starting Curve - Study

☑ Acceleration Study

Report Name: MTR1

Report Date: 07-30-2007

Reference kV

● Calculated Base kV

○ User-Defined

kV: 0

Asymmetrical LRC

Asym. Factor: 1.76

Thermal Limit Curve

	Stall Time
☑ Hot Start	30
☐ Cold Start	40
☐ Stator Curve	